R E P O R T R E S U M E S

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AUTOMOTIVE DIESEL MAINTENANCE 2. UNIT XXV, MICHIGAN/CLARK TRANSMISSION--TROUBLESHOOTING.

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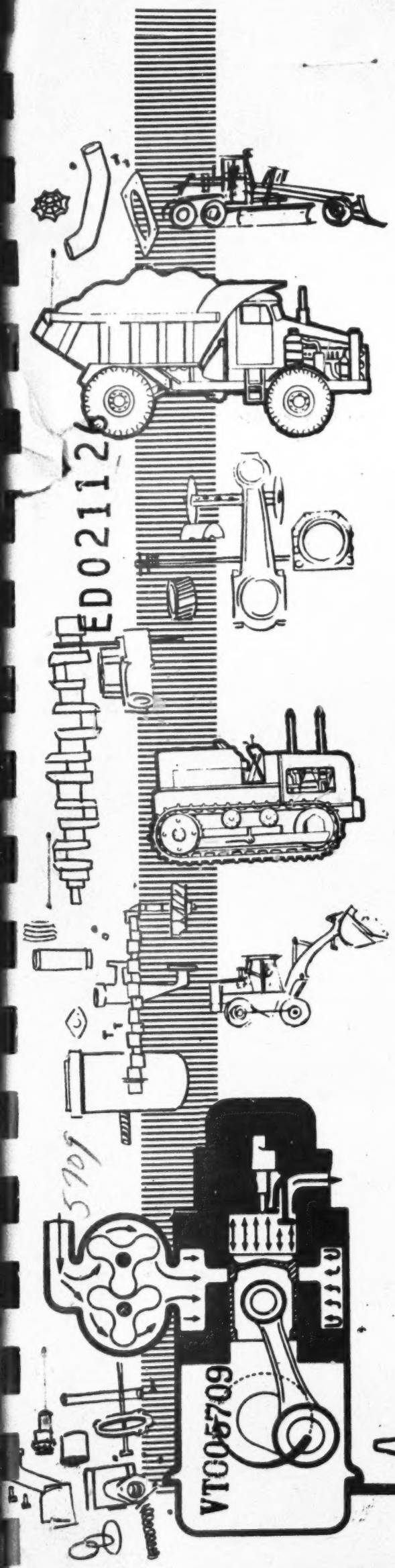
THIS MODULE OF A 25-MODULE COURSE IS DESIGNED TO DEVELOP AN UNDERSTANDING OF TROUBLESHOOTING PROCEDURES FOR A SPECIFIC TRANSMISSION USED ON DIESEL POWERED EQUIPMENT. TOPICS ARE (1) PRELIMINARY CHECKS, (2) PRESSURE AND OIL FLOW CHECKS, (3) TROUBLESHOOTING TABLES, (4) TROUBLESHOOTING VEHICLES UNDER FIELD CONDITIONS, AND (5) ANALYZING UNACCEPTABLE INSPECTION RESULTS. THE MODULE CONSISTS OF A SELF-INSTRUCTIONAL PROGRAMED TRAINING FILM "MICIGAN/CLARK TRANSMISSION--TROUBLESHOOTING" AND OTHER MATERIALS. SEE VT 005 685 FOR FURTHER INFORMATION. MODULES IN THIS SERIES ARE AVAILABLE AS VT 005 685 - VT 005 709. MODULES FOR "AUTOMOTIVE DIESEL MAINTENANCE 1" ARE AVAILABLE AS VT 005 655 - VT 005 684. THE 2-YEAR PROGRAM OUTLINE FOR "AUTOMOTIVE DIESEL MAINTENANCE 1 AND 2" IS AVAILABLE AS VT 006 006. THE TEXT MATERIAL, PROGRAMED TRAINING FILM, AND THE ELECTRONIC TUTOR MAY BE RENTED (FOR$1.75 PER WEEK) OR PURCHASED FROM THE HUMAN ENGINEERING INSTITUTE, HEADQUARTERS AND DEVELOPMENT CENTER, 2341 CARNEGIE AVENUE, CLEVELAND, OHIO 44115. (HC)



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STUDY AND READING MATERIALS

AUTOMOTIVE DIESEL MAINTENANCE 2

MICHIGAN/CLARK TRANSMISSION -- TROUBLESHOOTING

UNIT XXV

SECTION A	PRELIMINARY CHECKS
SECTION B	PRESSURE AND OIL FLOW CHECKS
SECTION C	TROUBLESHOOTING TABLES
SECTION D	TROUBLESHOOTING VEHICLES UNDER FIELD CONDITIONS
SECTION E	ANALYZING UNACCEPTABLE INSPECTION RESULTS

AM 2-25
10/19/67

Human Engineering Institute

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OFFICE OF EDUCATION

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HUMAN ENGINEERING INSTITUTE

This Unit is a troubleshooting guide for the Michigan/Clark transmissions and associated components. It is designed to aid the mechanic in locating the source of difficulty in a malfunctioning piece of equipment. Remember, that it is important to consider the torque converter, charging pump, transmission, oil cooler and connecting oil lines as a complete system when isolating the source of trouble, since the proper operation of any component within these systems depends greatly on the condition and operation of the others.

SECTION A -- PRELIMINARY CHECKS

MECHANICAL CHECKS -- Prior to checking any part of the system from a hydraulic standpoint, the following mechanical checks should be made:

1. Check to be sure that all control lever linkage is properly connected and adjusted at all connecting points.
2. Check shift levers and rods for binding or restrictions in travel that would prevent full engagement. Shift the levers by hand at transmission case; if full engagement cannot be obtained, the problem may be in control cover and valve assembly.

HYDRAULIC CHECKS -- Before checking the torque converter, check the transmission and associated hydraulic systems for pressure and rate of oil flow.

It is essential that the oil level in transmission be checked. This should be done with oil temperature of 180 to 200 F. DO NOT ATTEMPT THESE CHECKS WITH COLD OIL. To bring the oil temperature to this specification, it is necessary either to work the machine or stall out the converter. Where the former means is impractical, the latter means should be employed as follows:

Block wheels and apply parking brake. Engage shift levers in forward direction and the highest speed gear. Accelerate engine half to three-quarter throttle.

Hold stall until desired converter outlet temperature is reached.
CAUTION: FULL THROTTLE STALL SPEEDS HELD FOR AN EXCESSIVE LENGTH OF TIME WILL OVERHEAT THE CONVERTER.

SECTION B -- PRESSURE AND OIL FLOW CHECKS

Whenever improper performance is evident, the basic pressure and oil flow checks should be performed and recorded. It also is recommended that these checks be taken periodically as a preventive maintenance measure. Doing so can detect difficulties in advance of actual breakdown, thus permitting a scheduling of the repair operation. Likewise, repair of minor difficulties can be made at considerably less cost and downtime than if they are delayed until a major and complete breakdown occurs.

Comparing the results of these checks with specifications, and with each other, will indicate, in most cases, the basic item or assembly in the system that is the source of difficulty. Further checking of the assembly will isolate the specific cause of trouble.

OIL PRESSURE AT CONVERTER OUT PORT -- Install a hydraulic pressure gauge at the PRESSURE connection on the converter regulator valve of CONVERTER OUT. Check and record the oil pressure at 2000 rpm and at maximum speed (engine at full throttle). For the model series C-8000, the maximum pressure is 60 to 70 psi. For model series C-16000, it is 70 to 80 psi.

OIL PRESSURE AT CONVERTER IN PORT -- Install a hydraulic pressure gauge at the PRESSURE connection at CONVERTER IN. Check and record the oil pressure at stall and at maximum speed (engine at full throttle). Pressure must not go below 20 psi. NOTE: If pressures at converter out are available, converter in port pressure check is not necessary.

CONVERTER CHARGING PUMP -- If a flow meter is available, install it in the line between the converter charging pump and oil filters. The flow meter must be able to withstand 300 psi.

Disconnect the hose between the pump and filter at the filter end and, using suitable fittings, connect it to the pressure port of the tester. Install a hose between the filter and tester, connecting it to the reservoir port of the tester.

DO NOT USE TESTER LOAD VALVE AT ANY TIME DURING TEST.

When taking the flow reading, all readings should be taken on the first (left) half of the flow gauge. Whenever the needle points to the right half of the gauge, correct by switching to a higher scale.

If a flow meter is not available for checking converter pump output, proceed with manual transmission and converter checks. If the converter shows leakage within specifications and if clutch pressures are all equal within five psi, the converter pump must be inspected for wear.

Each Michigan/Clark transmission assembly is equipped with a converter pump of a certain capacity, varying from 11 to 65 gallons, depending on the model. Check the specifications for the capacity of the new pump on the model being tested.

A 20 percent tolerance below the capacity figure listed is permissible. However, if pump output is 20 percent or more BELOW the specified rating, it must be replaced -- NOT rebuilt.

TRANSMISSION CLUTCH LEAKAGE -- Check clutch pressures at low engine idle with oil at an operating temperature of 180 to 200 F. Engine speed must remain constant during entire leakage check. Shift the levers into forward and 1st speed, 2nd speed, 3rd speed, 4th speed, 5th speed, 6th speed, 7th speed and 8th speed. Record all pressures. Shift the direction lever into reverse and record the pressure. All pressures must be equal, within 5 psi. If clutch pressure varies in any one clutch more than 5 psi, repair the clutch. All pressures must be taken with two clutches engaged.

If a flow meter is available, install the meter in the line coming out of the converter pump. Check pump volume at 2000 rpm and at low engine idle. Record these readings.

Install the flow meter in the line coming from the transmission to the converter. Check oil volume at low idle in the following speed selections and record the readings.

Forward - 1st speed	Forward -5th speed
Forward - 2nd speed	Forward -6th speed
Forward - 3rd speed	Forward -7th speed
Forward - 4th speed	Forward -8th speed

Reverse - 1st speed

Subtract readings in each speed from pump volume reading to get transmission clutch leakage.

EXAMPLE: Pump volume at idle - 8 gal.

Forward - 1st speed	6 gal.	Pump volume	8 gal.
Forward - 2nd speed	6 gal.	Forward - 1st speed	
Forward - 3rd speed	6 gal.		6 gal.
Forward - 4th speed	6 gal.	Clutch leakage	2 gal.
Reverse - 1st speed	6 gal.		

If clutch leakage varies more than 1 gallon, repair the clutch.

LEAKAGE IN TRANSMISSION CLUTCHES

Leakage in 3000 series must not exceed 4 gal. max.
Leakage in 5000 series must not exceed 4 gal. max.
Leakage in 8000 series must not exceed 6 gal. max.
Leakage in 16000 series must not exceed 7 gal. max.

CONVERTER LUBE FLOW -- Disconnect CONVERTER DRAINBACK line at the transmission with the engine running at 2000 rpm, and measure the oil into a gallon container. Measure oil leakage for 15 seconds and multiply the volume of oil by four to get gallons per minute leakage.

LEAKAGE IN CONVERTER

Leakage in C270 series not to exceed 2 gal. max.
Leakage in C8000 series not to exceed 5 gal. max.
Leakage in C16000 series not to exceed 5 gal. max.

SECTION C -- TROUBLESHOOTING TABLES

The following tables indicate CAUSE or malfunction of the equipment and a REMEDY for the problem.

Table I Troubleshooting

CAUSE	REMEDY
LOW FLOW THROUGH COOLER WITH HIGH CONVERTER OUT PRESSURE	
1. Plugged oil cooler, indicated if transmission lube pressure is low	1. Back flush and clean oil cooler
2. Restricted cooler return line	2. Clean out lines
3. Lube oil ports in transmission plugged, indicated if transmission lube pressure is high	3. Check lube lines for restrictions
OVER-HEATING	
1. Worn oil sealing rings	1. Remove, disassemble and rebuild converter assembly
2. Worn oil pump	2. Replace
3. Low oil level	3. Fill to proper level
4. Pump suction line taking air	4. Check oil line connections and tighten securely
NOISY CONVERTER	
1. Worn coupling gears	1. Replace
2. Worn oil pump	2. Replace
3. Worn or damaged bearings	3. A complete disassembly will be necessary to determine which bearing is faulty
LACK OF POWER	
1. Low engine rpm at converter stall	1. Tune engine check governor
2. Over-heating	2. Make corrections as explained in over-heating above

Table I Troubleshooting (cont'd.)

CAUSE	REMEDY
LOW CLUTCH PRESSURE WITH NORMAL CLUTCH LEAKAGE	
1. Low oil level	1. Fill to proper level
2. Broken spring in transmission regulator valve	2. Replace spring
3. Clutch pressure regulator valve spool stuck in open position	3. Clean valve spool and sleeve
4. Faulty charging pump	4. See paragraph on charging pump output below
LOW CLUTCH PRESSURE WITH EXCESSIVE CLUTCH LEAKAGE	
1. Broken or worn clutch piston sealing rings	1. Replace sealing rings
2. Clutch drum bleed valve ball stuck in open position	2. Clean bleed valve thoroughly
3. Broken or worn sealing rings on clutch support	3. Replace sealing rings
4. Low converter charging pump output	4. See paragraph on charging pump output below
LOW CONVERTER CHARGING PUMP OUTPUT	
1. Low oil level	1. Fill to proper level
2. Sump screen plugged	2. Clean screen and sump
3. Air leaks at pump intake hose and connections or collapsed hose	3. Tighten all connections or replace hose if necessary
4. Defective oil pump	4. Replace pump

Table I Troubleshooting (cont'd.)

LOW FLOW THROUGH COOLER WITH LOW CONVERTER IN PRESSURE	
CAUSE	REMEDY
1. Defective safety bypass valve spring	1. Replace spring
2. Converter bypass valve partially open	2. Check for worn bypass ball seat
3. Excessive converter internal leakage. Check converter lube flow	3. Remove, disassemble,and rebuild converter assembly, replacing all worn or damaged parts
4. Broken or worn sealing rings in transmission clutches	4. See paragraph on clutch leakage on preceding page

Table II Troubleshooting the hydraulic shift control system

NOTE: Clutch pressure must be up to specifications before any of the following conditions are checked.

CAUSE	REMEDY
DELAYED SHIFT	
1. Check valve stuck open	1. Remove, clean or replace
2. Check valve spring broken	2. Replace
3. Accumulator precharge low	3. Precharge with nitrogen gas to 100 ± 10 psi
4. Restriction in supply line	4. Clean or replace
NO HIGH FORWARD CLUTCH ENGAGEMENT	
1. Range hose plugged	1. Clean or replace hose
2. HI-LO valve stuck	2. Remove spool, determine cause of sticking
CLUTCH ENGAGING AT THE WRONG TIME	
1. Hoses crossed between control valve and transmission control cover	1. Relocate hoses in proper positions
CLUTCHES NOT ENGAGING	
1. Hoses crossed between control valve and transmission control cover	1. Relocate hoses in proper positions
2. Speed valves in transmission control cover in wrong sequence	2. Remove speed valves and replace in proper position
3. Actuating plungers stuck in bore	3. Remove plungers, determine cause

SECTION D -- TROUBLESHOOTING VEHICLES UNDER FIELD CONDITIONS

In this troubleshooting section there are suggested charts which may be useful when inspecting or troubleshooting the vehicles.

Refer to Figure 1 to install gauges at the proper locations when performing the following checks.

1. 400 psi pressure gauge at location "B" to check clutch pressure at low idle, hot oil.
2. 200 psi pressure gauge at location "C" to check converter in pressure at stall and in neutral at 2000 rpm.
3. 200 psi pressure gauge at location "D" to check converter internal pressure at 2000 rpm and at HIGH FREE IDLE.
4. 100 psi pressure gauge to check lube pressure at location "F" at 2000 rpm and at HIGH FREE IDLE.
5. Converter leakage from converter drainback line.

With oil hot, disconnect drainback line at converter, then use a hose long enough to reach outside of the machine. Measure leakage for 15 seconds into a gallon measure. Multiply the oil leakage by four (4) to get gallons per minute. See troubleshooting chart for maximum leakage.

Pressure at "B" gives you condition of transmission.

Pressure at "C" gives you condition of pump and converter.

Pressure at "D" gives you condition of cooler at high rpm.

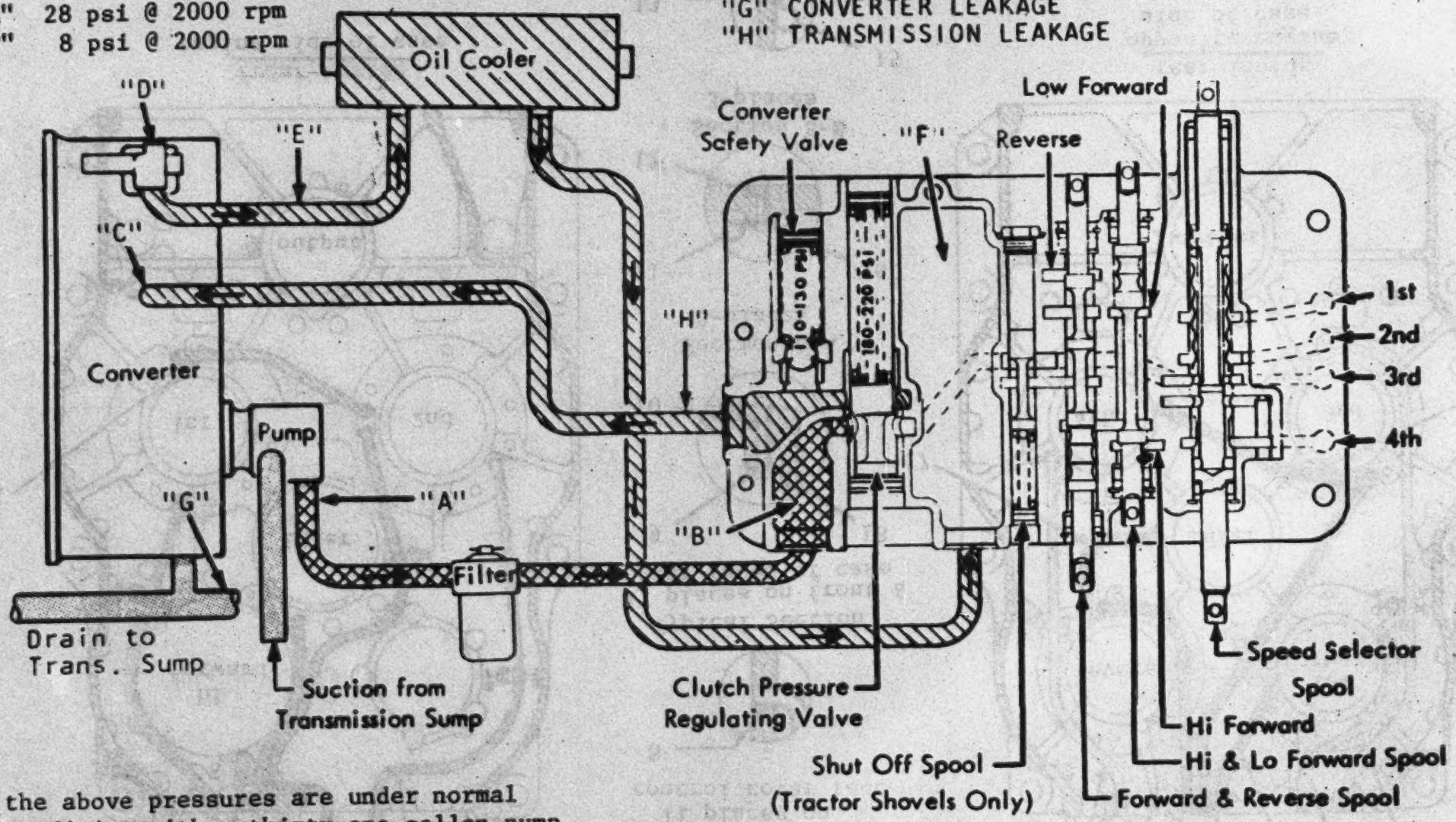
Pressure at "F" gives you condition of transmission lube to bearings and clutches. The normal pressure is 6 to 12 psi at 2000 rpm. Oil volume is the only thing that will create this pressure. If pressure is lower than normal, it means there is a low oil volume condition.

Check pump output or inspect converter charging pump. If pressure is higher than 25 psi at high free idle, then the tubing which guides the oil to the bearing and clutches is plugged. See Figure 2.

ALL PRESSURE CHECKS MADE WITH HOT OIL

"B" 180 psi to 220 psi @ low engine idle
"C" 80 psi @ 2000 rpm trans. in neutral
40 psi @ 2000 rpm stall.
"D" 60 psi @ high and low engine idle
"E" 28 psi @ 2000 rpm
"F" 8 psi @ 2000 rpm

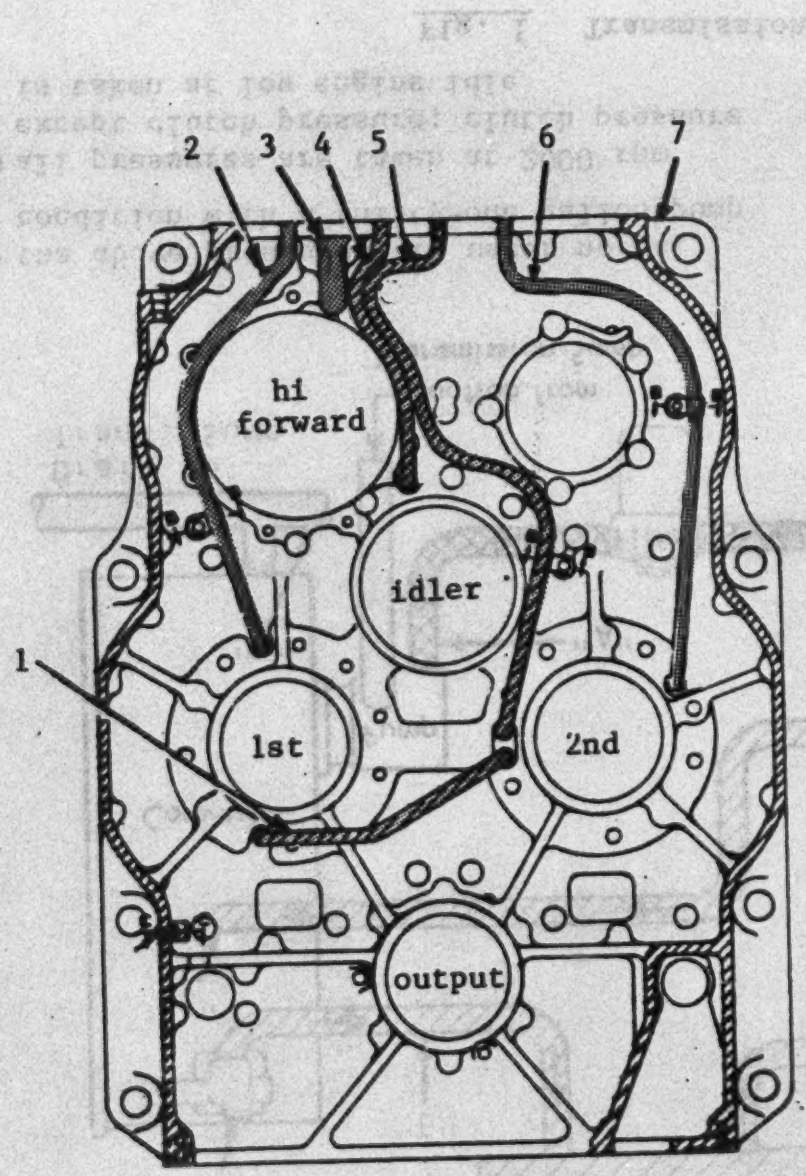
"A" PUMP OUT PUT
"B" CLUTCH PRESSURE
"C" CONVERTER IN PRESSURE
"D" CONVERTER INTERNAL PRESSURE
"E" COOLER IN PRESSURE
"F" LUB PRESSURE
"G" CONVERTER LEAKAGE
"H" TRANSMISSION LEAKAGE



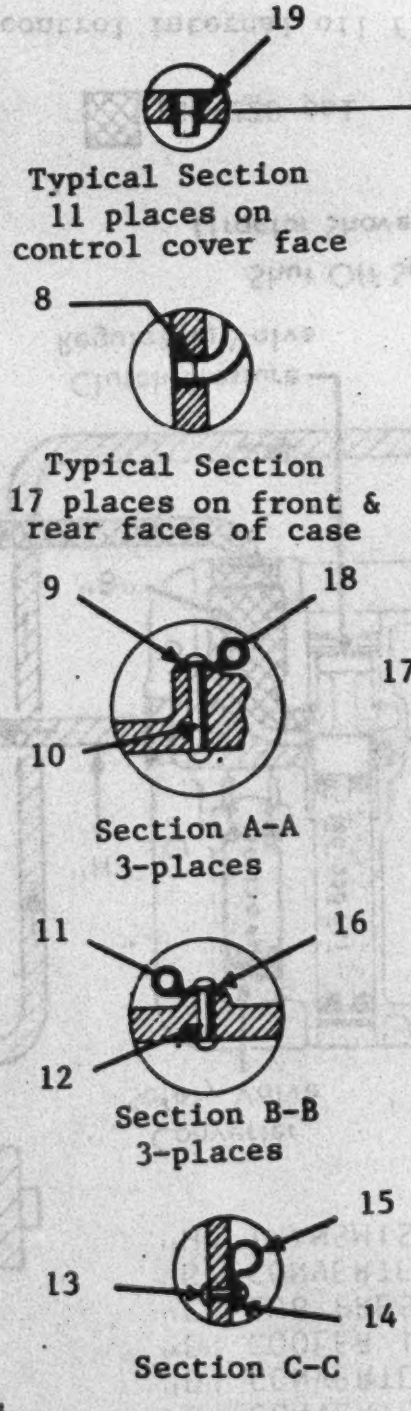
- the above pressures are under normal condition with a thirty-one gallon pump
- all pressures are taken at 2000 rpm except clutch pressure; clutch pressure is taken at low engine idle

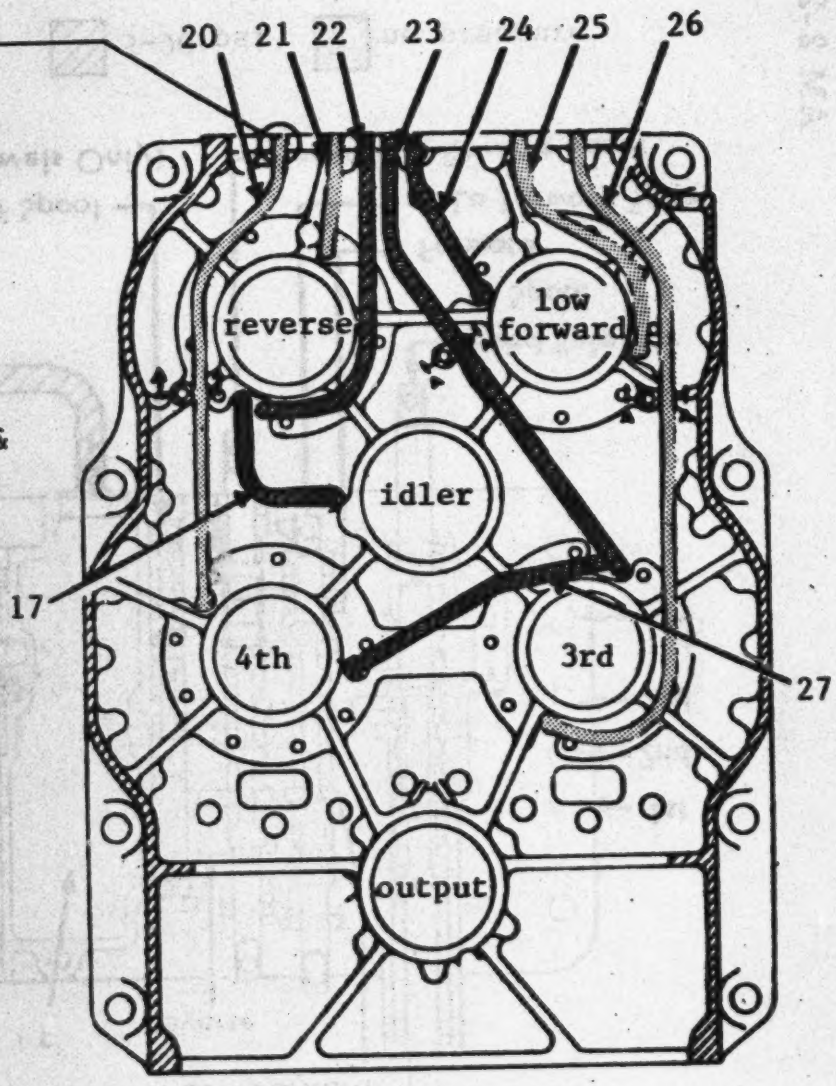
180-220 psi 5-90 psi no pressure

Fig. 1 Transmission control internal oil flow



front-inside
engine side of case





rear-inside
opposite engine
side of case

clutch pressure
shows flow to the clutches

lube pressure
shows flow to the bearings
and clutch disc

Fig. 2 Transmission internal tubing

The cooler has a normal 10 psi drop across the inlet and outlet. If a 150 psi gauge is installed at location "E" (see Figure 1), the gauge should show approximately 43 psi at 2000 rpm. This pressure at location "E" is a composite of the resistance that creates 43 psi. See example below.

EXAMPLE:
Five to 10 psi for each line going to and from cooler. Ten to 30 psi drop across cooler or back pressure in cooler. Six to 12 psi lube pressure at transmission location "F".

Add these pressures to get the total resistance at location "E".

Average	14 psi	lines
Average	20 psi	across cooler
Average	9 psi	lube
	43 psi	normal at location "E"

NOTE: The above check indicates the condition of the converter, transmission, pump and cooler.

The following tables indicate the allowable engine stall speeds for fluid use.
NOTE: These figures are current as of this publication. However, they are subject to change periodically, so check the appropriate maintenance manual.

MODEL	ENGINE	CONVERTER	MAIN RELIEF PRESSURE	MINIMUM ENGINE SPEED
			psi	rpm
55-III	F-265 (87)	12	2200	1550
	3-53 (80)	12	2200	1600
75-III	F-283 (100)	12	1900	1650
	4-53 (108)	12	1400	1750
85-III	C-160 (128)	13	2150	1700
	4-53 (118)	13	2150	1400
125-IIIA	V8R-220 (220)	14	2250	1700
	V6-200 (180)	14	2000	1400
175-III	V8R-240 (230)	15	1850	1200
	6V-71N65 (228)	15	1850	1300
175-IIIA	6V-71N65 (228)	15	1850	1300
	8V-71N60 (290)	15	2000	1750
275-III	8V-71N65 (304)	16	1750	1500
275-IIIA	NT-310 (310)	16	1750	1550
	NT-335 (335)	16	1750	1700
475-IIIA	VT12-635 (620)	17	2000	1800

Table III Minimum allowable stall speeds with main pump at relief pressure

MODEL	ENGINE	CONVERTER	MAIN RELIEF PRESSURE	MINIMUM ENGINE SPEED CONV.	W/PUMP
			psi	rpm	rpm
180 - III	C-175 (162)	14	1350	2100	1800
	6V-53-45 (162)	14	1350	2100	1800
280 - III	NT-290 (290)	16	1500	2050	1800
	NT-310 (310)	16	1500	2100	1900
	8V-71N60 (290)	16	1500	2000	1750
280 - IIIA	8V-71N65 (304)	16	1350	2050	1800
	NT-310 (310)	16	1350	2050	1850
380 - III	12V-71N65 (456)	17	1250	2050	1900

Table IV Minimum engine stall speeds with main pump at relief and at neutral

MODEL	NOMINAL	MAXIMUM
55III	15	35
75III	20	40
85III	20	40
125III	20	40
125IIIA	10	30
175III	10	30
175IIIA	10	30
275III	10	30
275IIIA	10	30
475IIIA	15	35
180III	15	35
280III	10	38
280IIIA	10	30
380III	5	25
110III	15	35
110H	15	35
310III	30	50
310H	30	50

All values at 2000 rpm with Type A converter oil at 200 to 250 F. Data will vary slightly depending on speed ratio.

Table V Oil cooler pressure drops for series III, III-A Michigan/Clark shovels and dozers

The following Charts are typical of what may be found when two different vehicles are inspected. Notice that in Chart I, the vehicle checked out all right. In Chart II, however, the readings indicate work to be done on the vehicle before it is returned to service.

Chart I Acceptable inspection results

Low engine idle		500 - 550 rpm
Engine stall speed (see stall procedures)		1500 @ 1750 psi
High free idle (hfi)		2300-2400 rpm
*Converter internal pressure @ low idle		60 psi
@ high free idle		70 psi
*Converter in pressure @ stall - 2000 rpm		40 psi
@ 2000 rpm, shift lever in neutral		80 psi
*Lube pressure @ 2000 rpm and hfi	6 to 12 psi	10 - 15 psi
*Pump volume @ low idle and 2000 rpm	6 to 10 gpm	31 gpm
Converter leakage @ 2000 rpm		3 gal.

*Transmission clutch pressure and leakage @ low idle

With flow meter in line from transmission to the converter, check oil volume at low idle in each speed. Subtract oil volume coming out of transmission in each speed from pump volume.

1st Gear	2 Gal.	190	LO-For-1st
2nd Gear	2 Gal.	190	HI-For-1st
3rd Gear	2 Gal.	190	LO-For-2nd
4th Gear	2 Gal.	190	HI-For-2nd
5th Gear	2 Gal.	190	LO-For-3rd
6th Gear	2 Gal.	190	HI-For-3rd
7th Gear	2 Gal.	190	LO-For-4th
8th Gear	2 Gal.	190	HI-For-4th
Reverse Gear	2 Gal.	190	Reverse-4th

*Normal pressure and oil flow

Chart II Unacceptable inspection results

Low engine idle		650 - 700 rpm
Engine stall speed (see stall procedures)		1875 rpm
High free idle (hfi)		2100 rpm
*Converter internal pressure @ low idle		45 psi
@ hfi		80 psi
*Converter in pressure @ stall - 2000 rpm		18 psi
@ 2000 rpm, shift lever in neutral		35 psi
*Lube pressure @ 2000 rpm and hfi	2 psi	5 psi
*Pump volume @ low idle and 2000 rpm	2 gal.	24 gpm
Converter leakage @ 2000 rpm		6 gal.

Transmission clutch pressure and leakage @ low idle

1st Gear	2 gal.	190	LO-For-1st
2nd Gear	2 gal.	190	HI-For-1st
3rd Gear	2 gal.	190	LO-For-2nd
4th Gear	2 gal.	190	HI-For-2nd
5th Gear	5 gal.	184	LO-For-3rd
6th Gear	5 gal.	184	HI-For-3rd
7th Gear	2 gal.	190	LO-For-4th
8th Gear	2 gal.	190	HI-For-4th
Reverse Gear	2 gal.	190	Reverse-4th

With flow meter in line from transmission to the converter, check oil volume at low idle in each speed. Subtract oil volume coming out of transmission in each speed from pump volume.

*Low pressure, low rpm, low volume

SECTION E -- ANALYZING UNACCEPTABLE INSPECTION RESULTS

In this section, a study of the figures obtained from inspecting the vehicle in Section D, Chart II, is presented. A possible remedy is given for the malfunctions indicated.

1. Low engine idle - 650 to 700 rpm

   Correct engine idle speed.

2. Engine stall speed - 1875 rpm

   Check engine for defects to stall speed.

3. High free idle - 2100 rpm

   Correct engine high free idle speed.

4. Converter internal pressure at low idle - 45 psi

   Check converter regulating valve for broken spring, or stuck in open position; low pump volume; low oil level; converter internal leakage.

5. Converter internal pressure high at hfi - 80 psi

   Check cooler for restriction; check lube tubing for foreign material; check lines for restriction; check converter regulating valve for sticking in closed position; cold oil.

6. Converter in pressure at stall - 18 psi

   Check pump volume; check transmission leakage; check oil level; check intake hose.

7. Converter in pressure at 2000 rpm,shift valve in neutral - 35 psi

   Same problems as above or at stall speed with low pressure.

8. Lube pressure at 2000 rpm - 2 psi

   Check oil level; check pump volume; check intake hose; check converter leakage; check transmission leakage.

9. Lube pressure at hfi - 5 psi

   Same checks as on previous page - low pressure is low oil volume.

10. Pump volume at low idle and 200 rpm - at low idle; 2 gpm; at 2000 rpm, 24 gpm

    Check oil level; check intake hose, install new pump; do not rebuild converter pump.

11. Converter leakage at 2000 rpm - 6 gal.

    Overhaul converter and replace any defective parts.

12. Transmission clutch pressure and leakage at low idle

    Chart II shows the 3rd speed clutch leaking oil. The pressure is down and leakage is up. The pressure is above specifications (180 to 220 psi) but it takes no more oil to engage 3rd speed clutch than it does any other clutch. It must be repaired. Eventual repair cost will increase if the repair is neglected or delayed.

DIDACTOR PLATES FOR AM 2-25 D

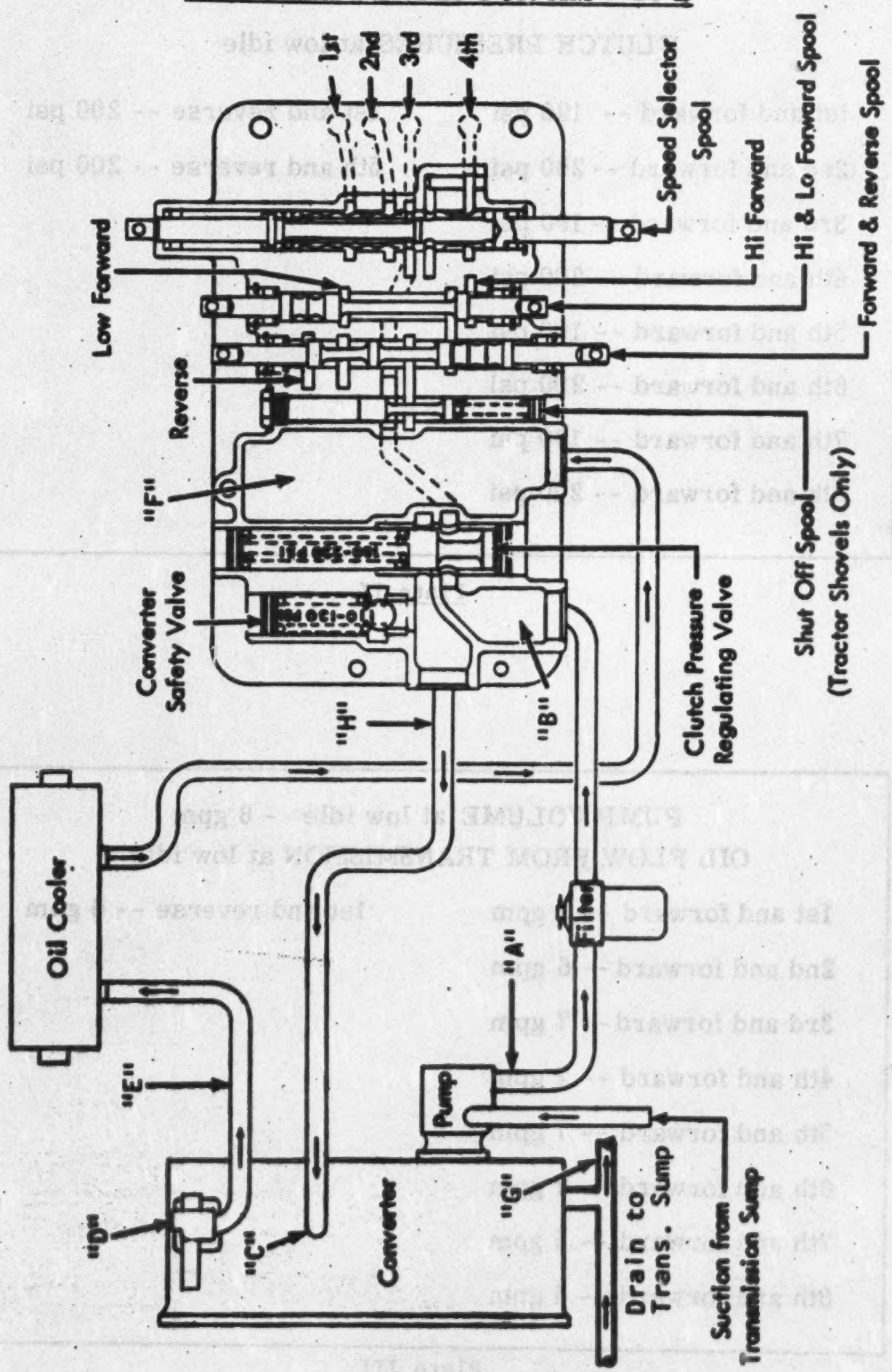


Plate I Hydraulic check points

CLUTCH PRESSURES at low idle

1st and forward -- 190 psi
2nd and forward -- 200 psi
3rd and forward -- 190 psi
4th and forward -- 200 psi
5th and forward -- 190 psi
6th and forward -- 200 psi
7th and forward -- 190 psi
8th and forward -- 200 psi
1st and reverse -- 200 psi
5th and reverse -- 200 psi

Plate II

PUMP VOLUME at low idle -- 8 gpm

OIL FLOW FROM TRANSMISSION at low idle

1st and forward -- 6 gpm
2nd and forward -- 6 gpm
3rd and forward -- 7 gpm
4th and forward -- 7 gpm
5th and forward -- 7 gpm
6th and forward -- 7 gpm
7th and forward -- 4 gpm
8th and forward -- 4 gpm
1st and reverse -- 6 gpm

Plate III

0

AM 2-25D
10/27/67

**MICHIGAN/CLARK TRANSMISSION --
TROUBLESHOOTING**

Human Engineering Institute
Minn. State Dept. of Ed.
Vocational Education

Press A 1 Check to see that timer and index are OFF.

1

Proper operation of off-highway vehicles equipped with the Michigan/Clark transmission and converter depends upon the smooth, efficient functioning of several components.

Each component -- the converter charging pump, the converter, the transmission, the oil cooler, and the connecting lines -- is part of a SYSTEM. A malfunction in one component can seriously affect the operation of the other individual components and the system as a whole.

Press A 2

1-1

2

In this film we will discuss a systematic approach to isolating the source of malfunctions which may occur.

We will discuss various mechanical and hydraulic checks which can be made in order to pinpoint the source of trouble.

Press A 3

1-2

3

Troubleshooting the Michigan/Clark converter and transmission system consists of two basic types of checks -- mechanical and hydraulic.

When a vehicle malfunctions, you should begin the troubleshooting process with the _____ checks.

A. hydraulic 4
B. mechanical 5

1-3

4

Incorrect.
Before making hydraulic checks in the system, it is best to start by making a few mechanical checks.

A simple mechanical adjustment may be all that is necessary to correct the problem.

Press A 5

1-4

5

OK.
Prior to making hydraulic checks, a few mechanical checks should be made. These are relatively simple to perform. The Michigan/Clark converter and transmission are physically separated from each other, to make them easier to get to when servicing is necessary.

Press A 6

1-5

6

Inaccurate oil pressure and flow readings, and incomplete clutch engagement may result from _____ in the mechanical shift linkage.

A. excess looseness or slack 7
B. binding or restriction of full travel 7
C. Either of the above 8

1-6

7

Your answer is correct, but is <u>incomplete</u>.

<u>Either</u> excessive looseness or slack, <u>or</u> binding and restriction of full travel in the mechanical shift linkage can cause incomplete clutch engagement and misleading pressure and flow readings.

Press A 8

1-7

8

OK. These mechanical checks are important:

1. Check all control levers and rods for proper connection and adjustment.

2. Check all rods and levers for binding or restrictions that would prevent full travel.

Press A 9

1-8

9

At the transmission case, shift the linkage by hand. If full engagement is not achieved, the source of trouble may be in the transmission control cover and valve assembly.

If the trouble cannot be corrected by mechanical adjustment, it will be necessary to make hydraulic checks to locate the source of difficulty.

Press A 10

1-9

10

Before making pressure and flow rate checks on the transmission, converter or other associated hydraulic components, it is essential to check the oil level in the transmission.

Accurate oil level checks are possible only when the oil is at normal operating temperature. The specified normal range is _____ F.

A. 110 to 130 11
B. 180 to 200 12
C. 90 to 110 11

1-10

11

No.
Keep in mind that we are talking about normal operating TEMPERATURE here -- not pressure.

The specified range of normal operating temperatures for the oil is 180 to 200 F.

Press A 12

1-11

12

OK. Check the transmission oil level with the oil temperature between 180 and 200 F.

DO NOT MAKE PRESSURE OR FLOW CHECKS WITH COLD OIL.

It may be necessary to operate the vehicle for a period of time in order to bring the oil up to specified temperature.

Press A 13

1-12

13

Is operating the vehicle the only way to bring the oil into the normal operating temperature range?

A. Yes 14
B. No 16
C. I'm not sure. 15

1-13

14

You are incorrect.

It may be impractical (or impossible) to operate the vehicle normally in order to bring the oil up to specified temperature.

In such cases, the desired oil temperature can be achieved by stalling out the converter.

Press A 16

1-14

15

In some cases it may be impractical to operate the vehicle normally to bring oil temperature up to specifications.

If this is so, the desired oil temperature can be achieved by stalling out the converter.

Press A 16

1-15

16

OK. If specified oil temperature cannot be achieved by any other means, it will be necessary to stall the converter.

Converter stall is achieved as follows:

1. Block wheels and apply parking brake
2. Shift control levers into FWD and highest speed range
3. Accelerate engine--1/2 to 3/4 throttle
4. Hold stall until desired converter outlet temperature is achieved

Press A 17

1-16

17

One of the following converter members normally rotates, but is held stationary during converter stall. Which is it?

A. Drive disc 18
B. Impeller 18
C. Turbine 19
D. Reaction member 18

1-17

18

No.

It is the converter TURBINE (the driven member) that normally rotates but is held stationary during converter stall.

The impeller (the driving member) pumps maximum oil volume against the stalled turbine. The violent swirling of oil that results is what raises the oil temperature.

Press A 19

1-18

19

OK.

Converter stall should be maintained at half to three-quarters throttle only until the oil comes into the 180 to 200 F range.

CAUTION: Maintaining converter stall at FULL THROTTLE for longer than thirty seconds at a time may overheat the oil and cause damage to converter and transmission seals.

Press A 20

1-19

20

To prevent possible damage due to overheating during converter stall, accelerate the engine intermittently to ___(1)___ throttle for periods of no longer than ___(2)___.

A. (1) 1/4 to 1/2 (2) 15 seconds 21
B. (1) 1/2 to 3/4 (2) 30 seconds 22
C. (1) full (2) one minute 21

1-20

21

No.

Proper oil operating temperature will be achieved quickly but safely if the engine is held at 1/2 to 3/4 throttle for intermittent periods of no longer than 30 seconds.

Press A 22

1-21

22

OK.

The oil used in the Michigan/Clark system serves two functions -- hydraulic operation of the converter and transmission, and lubrication of the system. The manufacturer specifies ordinary Type A automatic transmission fluid.

If you would like to review this introductory section, press A. 3

Otherwise, press B. 24

X(c)-23

1-22

23

OK.

Since you have had trouble with a question or two, let's have a brief review of this introductory section.

We'll discuss the hydraulic checks when you complete the section without an error.

Press A 3

1-23

24

HYDRAULIC CHECKS -- INTRODUCTION

Whenever mechanical adjustment alone does not correct improper vehicle performance, it is necessary to make certain basic oil pressure and flow checks. The results of each individual check should be recorded for comparison with the results of other checks and with manufacturer's specifications.

Press A 25

2-24

25

Is the information compiled in the various oil pressure and flow checks useful only as a means of pinpointing the source of a malfunction?

A. Yes XX
B. No 26

(Only the correct answer will move the film.)

2-25

26

That is correct.
The hydraulic checks are useful not only as a troubleshooting measure, but also as a routine preventive maintenance measure.

Taking these checks periodically makes it possible to detect problems prior to an actual breakdown in the field.

Press A 27

2-26

27

Periodic preventive maintenance checks allow you to schedule vehicle downtime. This is good maintenance management.

Usually it is better to take care of minor difficulties as they occur, rather than to wait for a major breakdown. Scheduled repairs of minor problems usually mean lower overall maintenance costs and less downtime in the long run.

Press A 28

2-27

28

By analyzing the results of oil pressure and flow checks, it is possible (in most cases) to isolate the assembly or component that is the source of a malfunction. Disassembly and visual inspection may then be necessary to pinpoint the specific source of trouble.

Let's discuss the specific hydraulic checks which may be necessary.

Press A 29

2-28

29

OIL PRESSURE AT CONVERTER OUT

Install a hydraulic pressure gauge at the pressure connection on the converter regulating valve. This point is marked converter out. Readings at this point give you converter internal pressure.

See Plate I. Converter internal pressure is read at _____.

A. location "G" 30
B. location "D" 32
C. location "C" 31

2-29

30

You are incorrect. (See Plate I.)

Location "G" is the check point for converter leakage (converter lube flow), which we will cover later in this film.

To check converter internal pressure, install a pressure gauge at location "D" (converter out).

Press A 32

2-30

31

Incorrect.
Location "C" is the check point for converter in pressure. We will talk about that shortly.

To check converter internal pressure, install a pressure gauge at location "D" (converter out).

Press A 32

2-31

32

OK. Converter internal pressure (converter out pressure) is read at location "D". This pressure should be checked both at 2000 rpm and at high free idle (engine at full throttle).

Maximum converter internal pressures for various converter models are:

Model C-270	40 to 45 psi
Model C-8000	60 to 70 psi
Model C-16000	70 to 80 psi

Press A 33

2-32

33

OIL PRESSURE AT CONVERTER IN

To check converter in pressure, install a hydraulic pressure gauge at location "C" (see Plate I). Check and record the pressures at 2000 rpm, both at stall and with the transmission in neutral.

Converter in pressure should not fall below ___ psi.

A. 20 35
B. 60 34
C. 80 34

2-33

34

Your answer is incorrect.

In another film we said that the normal pressure at location "C" is 80 psi in neutral at 2000 rpm.

The MINIMUM converter in pressure specified by the manufacturer is 20 psi.

Press A 35

2-34

35

OK. Minimum pressure at location "C" (Plate I) is 20 psi.

If there is low oil flow through the cooler and if converter in pressure also is low, the trouble is most likely _____.

A. a broken spring in the check valve 36
B. plugged lube oil ports in the transmission 37
C. a worn ball seat in the converter bypass valve 38

2-35

36

No.
The malfunction most likely to appear when the check valve spring is broken (or when the check valve is stuck open) is delayed shifting.

Low oil flow through the cooler and low converter in pressure will result when the converter bypass valve ball seat is worn.

Press A 38

2-36

37

No.

Plugged lube oil ports in the transmission do cause low oil flow through the cooler, but this usually is associated with high converter out pressure.

Low cooler oil flow and low converter in pressure will result when the converter bypass valve ball seat is worn.

Press A 38

2-37

38

OK.
Low converter in pressure also may be caused by a defective charging pump.

To test the charging pump, connect a flow meter between the pump and the filter. Disconnect the line between the pump and filter at the filter end.

The line disconnected at the filter should be connected to the _____ port of the flow meter.

A. pressure 40
B. reservoir 39

2-38

39

No.
You should detach the line between the pump and filter at the filter end, and connect this line to the PRESSURE port of the flow meter.

Press A 40

2-39

40

OK. The line leading from the pump should be attached to the pressure port of the flow meter.

Then attach a hose between the reservoir port of the meter and the filter connecting point.

Charging pump flow checks are made at _____.

A. high free idle 44
B. 2000 rpm 42
C. low idle 41

2-40

41

No.
The rated output for a new converter charging pump is the gpm output of that pump at 2000 rpm. A 31 gallon pump, for example, will deliver 31 gpm at 2000 rpm when new.

Charging pump flow checks also are made at 2000 rpm.

Press A 42

2-41

42

OK. Take the pump output check at 2000 rpm.

Do not use the tester load valve at any time during the test. If the needle points to the right half of the flow gauge, switch to the next higher scale.

The pump is defective if the flow gauge reads more than _____ percent below the rated output for the pump.

A. 30 43
B. 10 43
C. 20 44

2-42

43

No.
A 20 percent tolerance below rated pump output is permissible. If the flow rate falls below that figure, the pump is defective.

A pump rated at 40 gallons, for example, is defective if it shows less than 32 gpm on the flow check.

Press A 44

2-43

44

OK. The pump is defective if its flow rate falls more than 20 percent below its rated capacity.

A defective converter charging pump should be _____.

A. repaired if possible 45
B. replaced 46

2-44

45

No. The manufacturer recommends that no attempt be made to repair a defective charging pump.

Defective pumps should be replaced.

Press A 46

2-45

46

OK. Do not attempt to repair a defective charging pump. Replace it.

If you would like to review this section, starting with our discussion of preventive maintenance, press A. 24

Press B if you would like to review only the hydraulic checks at converter in, converter out and at the charging pump. 29

Press E if you prefer to go on.

48 X(c)-47

3-46

47

OK. Replace the defective converter charging pump. Do not attempt to repair it.

You have made an error or two on the questions in this section, so let's have a quick review.

If you would like your review to begin with our brief discussion of preventive maintenance, press A. 24

Press B if you want to review only the hydraulic checks at converter out, converter in and at the charging pump. 29

2-47

48

TRANSMISSION CLUTCH PRESSURE AND LEAKAGE

If the pump output test does not disclose the source of trouble, proceed to the clutch pressure checks.

See Plate I. Clutch pressures are checked at _____.

A. location "F" 49
B. location "B" 51
C. location "H" 50

3-48

49

You are incorrect. (See Plate I.)

Pressure at location "F" is transmission lube pressure. We'll talk more about this later in the film.

CLUTCH PRESSURE checks are taken at location "B".

Press A 51

3-49

50

Incorrect. (See Plate I.)

Location "H" is the check point for oil volume between the transmission and converter. This check helps you to determine clutch leakage. We'll talk more about clutch leakage shortly.

CLUTCH PRESSURE checks are taken at location "B".

Press A 51

3-50

51

OK. Check clutch pressures at location "B". (Plate I)

Remember that all pressures must be taken with hot oil and with two clutches engaged. Engine speed must remain constant (low idle) throughout the clutch pressure and leakage checks.

Shift the direction control lever into FWD and check pressure in 1st through 8th speeds. Record the pressure for each range.

Press A 52

3-51

52

Next, shift the direction control lever into REV and check the pressure in at least the 1st speed range. Record this pressure.

If all pressures recorded thus far are EQUAL or are within five psi of one another, it will not be necessary to check any more combinations of clutches for pressure.

Press A 53

3-52

53

A faulty clutch can be discovered by the process of elimination. When the pressure in any clutch varies more than five psi from the others, it must be repaired or replaced.

See Plate II. This is a list of pressures obtained in a clutch pressure check. From this information, you would suspect that the _____.

A. LO forward clutch is defective 56
B. HI forward clutch is defective 54
C. odd-numbered speed clutches both are defective 55

3-53

54

You are incorrect. (See Plate II.)

Note that the pressures obtained in forward and the odd-numbered speed ranges are low -- 190 psi, compared to 200 psi for all other combinations.

We know that in the odd-numbered forward speed ranges the LO FORWARD clutch is engaged. Since the pressure is low in each range in which the LO FORWARD clutch is engaged, that clutch is defective.

Press A 56

3-54

55

You are incorrect. (See Plate II.)

Note that the pressures obtained in ALL the odd-numbered forward SPEED RANGES are low -- 190 psi, compared to 200 psi for all other combinations.

We know that in the odd-numbered forward speed ranges, the LO FORWARD clutch is engaged. Since the pressure is low in each range in which the LO forward clutch is engaged, that clutch is defective.

Press A 56

3-55

56

OK. (See Plate II.) The pressures are low in the odd-numbered forward speed ranges only. This means that the LO FORWARD clutch is defective.

If the pressures had been low in the even-numbered forward gears, and equal in all other combinations, it would mean that the HI FORWARD clutch is defective. The HI FORWARD clutch is engaged in all the even-numbered forward gears.

Press A 57

3-56

57

Let's say that you check all the forward clutch combinations and find that the pressures are equal within five psi, except for the 1st and forward, and the 2nd and forward gear combinations.

This means that the _____.

A. first and second speed clutches are both defective 58
B. second speed clutch is defective 59
C. first speed clutch is defective 60

3-57

58

No.
If all other combinations are equal within five psi, and if the pressures vary more than five psi in forward and the 1st and 2nd speed ranges, it means that only the FIRST speed clutch is defective.

The first speed clutch is engaged with the LO forward clutch in 1st speed range and with the HI forward clutch in 2nd speed range.

Press A 60

3-58

59

No.
The second speed clutch is NOT engaged in either the 1st or 2nd speed range. In 1st and 2nd speeds, only the FIRST speed clutch is engaged (with LO forward in 1st; with HI forward in 2nd).

Since the pressures are equal within five psi in all other combinations, the FIRST speed clutch is defective.

Press A 60

3-59

60

OK. The first speed clutch is defective.

If all pressures had been equal within five psi except those obtained in forward and 3rd, and forward and 4th, then the SECOND speed clutch would have been defective. The second speed clutch is engaged in the 3rd and 4th speed ranges.

Press A 4

3-60

61

If the source of trouble is not found by checking clutch pressures, proceed with the clutch leakage checks. See Plate I.

The leakage for a clutch is determined by SUBTRACTING the oil flow at location "H" from the pump volume flow, taken at location "A". Again, each speed range should be checked in forward. At least the 1st speed range in reverse should be checked.

Press A 62 X(c)-61.1

3-61

61.1

You have had some trouble with at least one question so far.

Before we discuss the clutch leakage checks, let's have a quick review of the clutch pressure checks.

Press A 48

3-61.1

62

See Plate I.
We will assume that you have already checked pump output at 2000 rpm (as discussed in the previous section of this film), and have found the pump to be in good condition.

For the clutch leakage checks it will be necessary to check pump output at LOW IDLE. Install a flow meter at location "A" and record the reading.

Press A 63

3-62

63

Now, install the flow meter at location "H" (Plate I). Check the oil volume flow at low idle in all speed ranges in forward, and in at least the first speed range in reverse. Record each reading carefully.

In order to determine the clutch leakage, subtract the reading obtained in each speed range from the original pump output reading taken at location "A".

Press A 64

3-63

64

See Plate III. This is a list of readings obtained in a clutch leakage check. The pump output volume was found to be eight gpm.

The oil flow from the transmission at location "H" (Plate I) is six gpm in the forward and 1st and the forward and 2nd speed combinations.

This means that leakage past the first speed clutch is _____ gpm.

A. six 65
B. two 66
C. eight 65

3-64

65

Incorrect. (See Plate III.)

The pump volume in this case is eight gpm. In both the 1st and 2nd speed ranges, the flow from the transmission is six gpm. We know that the first speed clutch is engaged in both the 1st and 2nd speed ranges.

In either case, the leakage past the first speed clutch is eight minus six or two gpm.

Press A 66

3-65

66

OK.

The leakage past the first speed clutch is two gpm (eight gpm minus six gpm). See Plate III.

The manufacturer recommends that if leakage in a clutch varies more than one gpm from the others, it should be repaired or replaced.

From the readings listed in Plate III, it appears that the _____ speed clutch is defective.

A. second 67
B. third 67
C. fourth 68

3-66

67

No.
Clutch leakage is one gpm for both the second and third speed clutches.

Oil flow in 3rd and 4th is seven gpm. Eight gpm minus seven gpm equals one gpm leakage past the second speed clutch. The same is true for the third speed clutch (engaged in 5th and 6th gears).

Press A 68

3-67

68

OK. See Plate III. In the 7th and 8th speed ranges, oil flow from the transmission is four gpm. The FOURTH speed clutch is engaged in 7th and 8th speeds.

In either case the leakage past the fourth speed clutch is four gpm (eight gpm minus four gpm). Since this figure varies from the leakage around the other clutches by more than one gpm, the fourth speed clutch is defective and must be serviced. (It also appears that the first speed clutch needs some attention.) Press A 69

3-68

69

The leakage around any one of the clutches can be determined by a systematic comparison of the oil flow readings in the different speed and direction ranges.

The manufacturer also lists specifications for maximum TOTAL leakage around the clutches for the various vehicle series. In the 18000 Series, for example, the combined total leakage around all the clutches must not exceed seven gpm. Press A 70

3-69

70

A certain amount of leakage around each clutch is normal. Assuming that we are speaking of a vehicle of the 18000 Series, the leakage around any single clutch must not exceed _____ gpm.

A. seven 71
B. two 71
C. one 72

3-70

10

71

Your answer is incorrect.

Remember that there are SEVEN clutches in the Michigan/Clark transmission -- four speed clutches and three direction clutches. Manufacturer's specifications state that maximum total clutch leakage for the 16000 Series is seven gpm.

Since there are seven clutches, and since we can expect SOME leakage around each clutch, the maximum allowable leakage around an individual clutch is one gpm.

Press A 72

3-71

72

Good. The maximum leakage for any single clutch in a 16000 Series vehicle is about one gpm.

You have completed this section on transmission clutch pressure and leakage without an error. If you would like to review this section, press A. 48

Press B 4 if you want to review only the section on clutch leakage.

Press E if you prefer to go on.

74 X(C)-73

4-72

73

OK. In a 16000 Series vehicle, the leakage past any clutch should not exceed one gpm.

Since you have made an error or two on the questions, let's have a quick review. Press A if you want to review both the checks for clutch pressure and clutch leakage. 48

Press B if you want to review only the clutch leakage checks. 61

3-73

74

LUBE FLOW AND CONVERTER LEAKAGE

See Plate I. At location "F" you can check the transmission lube pressure going to the bearings and clutches. This pressure check should be taken at 2000 rpm and at high free idle. The normal pressure at 2000 rpm is 6 to 12 psi. The maximum recommended pressure at high free idle is 25 psi.

Press A 75

4-74

75

If the pressure at location "F" (Plate I) is lower than six psi: _____.

A. the oil volume probably is low ~~75~~ 77

B. the tubing that feeds the bearings and clutches probably is clogged 76

4-75

76

No.
Clogged lubrication tubing will cause the lube pressure to be higher than normal.

When lube pressure is LOWER than normal (less than 6 to 12 psi), you should suspect low oil volume.

Press A 77

4-76

77

OK. (See Plate I.) If the pressure at 2000 rpm is lower than six psi (at location "F"), there is low oil volume. It will be necessary to check pump output.

If lube pressure is higher than _____ psi at high free idle, the lubrication tubing probably is clogged.

A. 6 78
B. 12 78
C. 25 79

4-77

78

Incorrect.
Normal lube pressure is 6 to 12 psi at 2000 rpm.

At high free idle (engine at full throttle), the lube pressure normally will not exceed 25 psi. Any pressure higher than this indicates clogged lubrication tubing.

Press A 79

4-78

79

OK. Maximum normal lube pressure at high free idle is 25 psi.

As a general rule, pressures below normal indicate LOW OIL VOLUME. Pressures above normal indicate that something is CLOGGED (normal flow is restricted).

Press A 80

4-79

80

The manufacturer also issues specifications for maximum converter leakage for the various vehicle series.

To check converter leakage, disconnect the converter DRAINBACK LINE (Plate I, location "G"). Connect an auxiliary hose to the drainback line. With the engine at 2000 rpm, collect the leakage from this hose for 15 seconds.

Press A 81

4-80

81

Measure the volume of oil you have collected in 15 seconds, and multiply this volume by four to get the converter leakage in gallons per minute. Compare this against manufacturer's specifications.

See Plate I. Converter leakage is measured from _____.

A. location "A" 82
B. location "D" 82
C. location "G" 83

4-81

82

No. (See Plate I.)

Converter leakage is checked by disconnecting the converter drainback line. Converter leakage is measured from location "G".

Press A 83

4-82

83

OK.

According to manufacturer's specifications, converter leakage in the C8000 Series must not exceed five gpm at 2000 rpm.

This means that leakage measured from location "G" (Plate I) may not exceed _____ gallons in 15 seconds.

A. 1 1/4 85
B. 1 1/2 84
C. 2 84

4-83

84

You are incorrect.

Maximum allowable converter leakage for the C8000 Series is five gpm at 2000 rpm.

If the maximum allowable leakage is five gallons per minute, then the maximum allowable leakage for 15 seconds is 1 1/4 gallons per minute. Five divided by four equals 1 1/4 gallons per 15 seconds.

Press A 86

4-84

85

OK.

If you would like a brief review of the lube flow and converter leakage checks, press A. 74

Otherwise, press B. 87

X(C)-86

4-85

86

OK. Maximum allowable oil leakage from a C8000 Series converter is 1 1/4 gallons in 15 seconds (at 2000 rpm).

Let's have a quick review of the lube flow and converter leakage checks now, since you made an error on at least one question.

Press A 74

4-86

87

This section of the film is intended as a quick review, to help you remember the locations for the various hydraulic checks required on Michigan/Clark converter and transmission assemblies.

Refer to Plate I throughout this section. In each case, only the correct answer will move the film.

Press A 88

4-87

88

See Plate I.

Converter out pressure is measured at _____.

A. location "G" XX
B. location "D" 89
C. location "C" XX

Remember that only the correct answer will move the film.

4-88

89

OK. Converter out pressure (converter internal pressure) is checked at location "D".

Converter in pressure is measured at _____.

A. location "A" XX
B. location "B" XX
C. location "C" 90

4-89

90

OK. Converter in pressure is checked at location "C".

Pump output is measured at _____.

A. location "A" 91
B. location "B" XX
C. location "G" XX

4-90

91

OK. Pump output is checked at location "A".

Clutch pressure is measured at _____.

A. location "F" XX
B. location "B" 92
C. location "H" XX

4-91

92

OK. Clutch pressure is checked at location "B".

Transmission clutch leakage is measured at _____.

A. location "F" XX
B. location "G" XX
C. location "H" 93

4-92

93

OK. Clutch leakage is checked at location "H".

Converter leakage is measured at _____.

A. location "A" XX
B. location "D" XX
C. location "G" 94

4-93

94

OK.
Converter leakage (lube flow from the transmission) is checked at location "G".

Transmission lube pressure is measured at _____.

A. location "F" 95
B. location "B" XX
C. location "E" XX

4-94

95

OK. Lube flow to the transmission bearings and clutches is checked at location "F".

If you would like to run through this brief review of hydraulic check points again, press A. 87

Otherwise, press B. 96

4-95

96

Congratulations!

You have successfully completed this film on trouble-shooting the Michigan/Clark transmission and converter assemblies. This concludes the series of film lessons covering Michigan/Clark equipment.

Press REWIND.

4-96

INSTRUCTOR'S GUIDE

Title of Unit: MICHIGAN/CLARK TRANSMISSION -- TROUBLESHOOTING

AM 2-25
10/19/67

OBJECTIVES for this Unit:

1. To give the student a series of systematic inspection and troubleshooting checks.
2. To present certain readings (rpm, gpm, psi) which are critical when inspecting and troubleshooting the various Michigan/Clark transmissions.

LEARNING AIDS suggested:

Models:

Arrangements can be made to have a working model of a Michigan/Clark transmission at your center. A teardown and reassembly of this equipment on a class participation basis would be excellent during these discussions.

QUESTIONS DESIGNED FOR CLASS PARTICIPATION:

1. What are the preliminary checks that should be made when troubleshooting a unit?
2. How can the oil be brought up to the desired temperature for purposes of checking?
3. What oil pressure reading should be obtained at converter out? At converter in?
4. How can transmission clutch leakage be checked?
5. How can converter lube flow be checked?
6. What can cause a low volume oil condition?
7. In making checks across the cooler, what makes up the reading that is obtained at (E) in Figure 1 ?